SATARaid™

SATA RAID SOFTWARE
to be used with the Sil 3112A

User's Manual

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Silicon Image

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1. OVERVIEW

Product Overview

Silicon Image's SATARaid™ provides Serial ATA Software RAID including Striping and Mirroring to enhance the industry's first proven PCI-to-SATA host controller product. Two major challenges facing the storage industry today are keeping pace with the increasing performance demands of computer systems by improving disk I/O throughput and providing data accessibility in the face of hard disk failures. With the SiI 3112A Serial ATA host controller and SATARaid, both of these problems are solved.

RAID Striping greatly improves hard disk I/O performance by concurrently Striping data across multiple drives. RAID Mirroring enables users to enjoy the confidence of data availability regardless of a single disk failure as data is simultaneously written to two drives.

Standard with SATARaid software is a Graphical User Interface (GUI) that provides easy-to-use configurations for the different RAID Sets supported.

SATARaid Features

- RAID 0 and 1
- Hot Spare and On-line Mirror Rebuilding
- System GUI Monitoring Utility:
  - Displays/Logs/Alerts Users to Vital RAID Set Information
  - Manages RAID Set Functions (configures, rebuilds, etc.)
- RAID Set Accommodates Multiple Size HDDs
- HDDs Function Normally When Not in RAID Sets
- Adjustable Stripe Size for RAID 0
- Automatically Selects Highest Available Transfer Speed for All ATA and ATAPI Devices
- Supports:
  - UDMA up to 150MB/Sec.
  - All UDMA and PIO Modes
  - Up to 2 SATA devices
  - ACPI and ATA/ATAPI6

RAID Explained

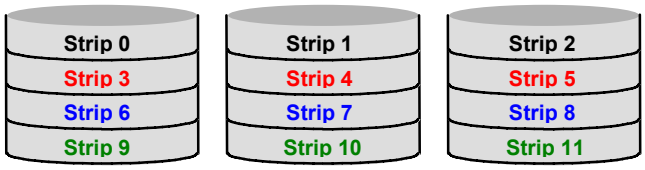
RAID - Redundant Array of Independent Disks

RAID technology manages multiple disk drives to enhance I/O performance and provide redundncy in order to withstand the failure of any individual member, without loss of data.

SATARaid provides two RAID Set types, Striped (RAID 0) and Mirrored (RAID 1).

Disk Striping (RAID 0)

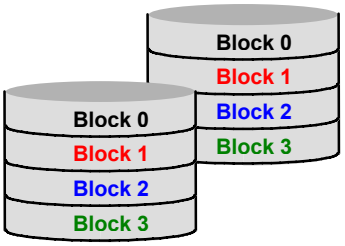
Striping is a performance-oriented, non-redundant data mapping technique. While Striping is discussed as a RAID Set type, it is actually does not provide fault tolerance. With modern SATA and ATA bus mastering technology, multiple I/O operations can be done in parallel, enhancing performance. Striping arrays use multiple disks to form a larger virtual disk.



This figure shows a stripe set using three disks with stripe one written to disk one, stripe two to disk two, and so forth.

Disk Mirroring (RAID 1)

Disk mirroring creates an identical twin for a selected disk by having the data simultaneously written to two disks. This redundancy provides instantaneous protection from a single disk failure. If a read failure occurs on one drive, the system reads the data from the other drive.



2. INSTALLING DRIVERS AND SOFTWARE

Windows XP/2000 Operating System

The driver is located on the provided floppy disk. Insert the floppy disk into the floppy disk drive and click **Browse.**

Most floppy disk drives are configured as **[A:]**. Choose the **[A:]** drive in your browser and the **Si3112r.inf** file for the Sil 3112A. Select the file and click **Open**:

Verify that the directly listed in this window is A: and click **OK**.

Now, a window verifying that the new Driver for the board has been properly installed. Click **Finish.**

It is always good to Restart the computer after an installation.When asked to do so, Click **Yes**.

To install SATARaid, use Windows InstallShield by performing the following:

1. After computer restarts, insert cd in disk drive.
2. Double-click on **Install SATARaid.exe**.
3. Follow on-screen instructions to complete installation. **Note:** Do **NOT** install in the Start Up folder. Choose the Default folder (normally Accessories or Administrative Tools or something similar).

Windows NT Operating System

The driver is on the provided floppy disk, insert the floppy in the floppy disk drive and click **Have Disk.**

The next window is asking for the location of the driver. Most floppy disk drives are configured as **[A:]**. To verify, click on **Browse**.

The next window verifies that the appropriate file is located on **[A:]**. Select the file **Oemsetup.inf** and click **Open**.

[A:] should appear in the window. Click **OK.**

The next window allows you to select which driver to install. Only one driver should appear in this window. Select **Sil 3112A Raid Controller** and click on **OK**.

It is always good to Restart the computer after an installation. Click **Yes**.

To install the SATARaid GUI, use Windows InstallShield by performing the following:

1. After computer restarts, insert cd in disk drive.
2. Double-click on **Install SATARaid.exe**.
3. Follow on-screen instructions to complete installation. **Note:** Do **NOT** install in the Start Up folder. Choose the Default folder (normally Accessories or Administrative Tools or something similar).

Windows 98/Me Operating System

Follow the instructions in each window, using the driver installation files (sil3112r.sys) on the provided floppy disk as necessary.

To install the SATARaid GUI, use Windows InstallShield by performing the following:

1. After computer restarts, insert cd in disk drive.
2. Double-click on **Install SATARaid.exe**.
3. Follow on-screen instructions to complete installation. **Note:** Do **NOT** install in the Start Up folder. Choose the Default folder (normally Accessories or Administrative Tools or something similar).

3. CREATING/DELETING RAID SETS

Creating and deleting RAID sets is a function found in the BIOS. During bootup, the following message will appear, pausing for a few moments to allow the user to choose what to do:

```
Press <CRTL-S> or F4 to enter RAID utility
```

An easy-to-use screen will appear with the following choices in the top left:

Create RAID Set
Delete RAID Set
Rebuild RAID Set
Resolve Conflicts

Below this will be listed the drives currently installed on the system.

The top right half of the screen displays directions and comments for the user. The bottom right half lists the command keys:

Arrows up and down are Select Keys
ESC takes the user to the previous menu
Enter selects the user's choice
Ctrl-E exits the utility

Creating RAID Sets

Becuase SATARaid supports two drives, creating RAID Sets is a simple procedure.

1. Select "Create RAID Set."
2. Choose either a "Striped" or "Mirrored" RAID Set.
3. Select if you want the utility to Auto Configure the RAID Set or if you want to manually configure the RAID Set. For Striped Sets, you can change the chunk size. For Mirrored Sets, you assign which is the Source and Target drives, as well as if you want Disk Copy.

   What is Disk Copy? If the disk assigned as the source disk already has been partitioned and has data stored on it, and then a second disk is added for redundancy, the data on the source drive can be copied to the destination drive, so the disks are identical, and all subsequent data will be written to both drives as a Mirrored set. If, however, the source disk does not have data already stored on it, there is no need for Disk Copy.

4. The utility will ask "Are You Sure?" before completing the configuration.

Deleting RAID Sets

1. To remove one or more RAID sets, select “Delete RAID Set.”
2. Select desired set and press Y when asked “Are You Sure?”

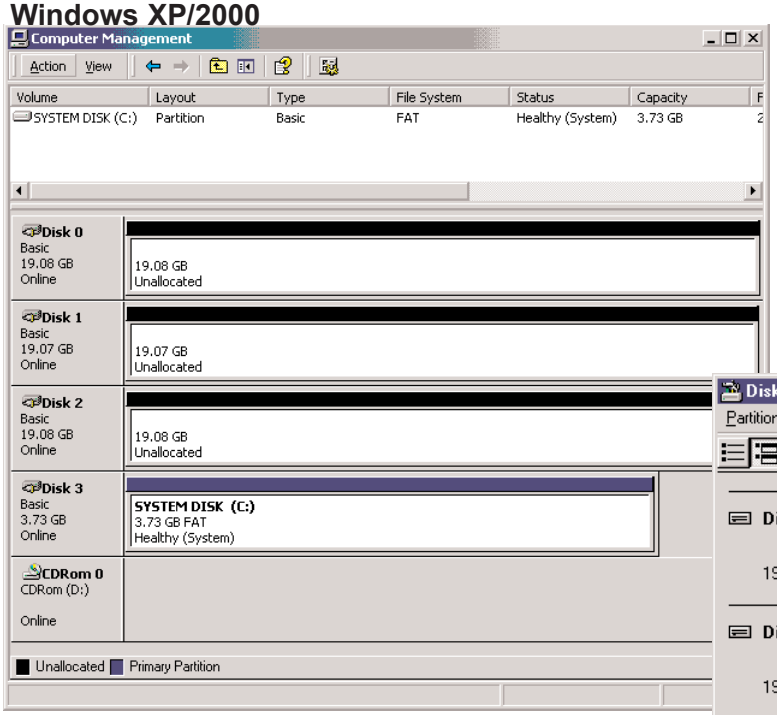
Resolving Conflict

When a RAID set is created, the metadata written to the disk includes drive connection information (Primary Chanel, Secondary Channel). If, after a disk failure, the replacement disk was previously part of a RAID set (or used in another system), it may have conflicting metadata, specifically in reference to the drive connection information. If so, this will prohibit the RAID set from being either created or rebuilt, In order for the RAID set to function properly, this old metadata must be first overwritten with the new metadata. To resolve this, select “Resolve Conflict” and the correct metadata, including the correct drive connection information, will be written to the replacement disk.

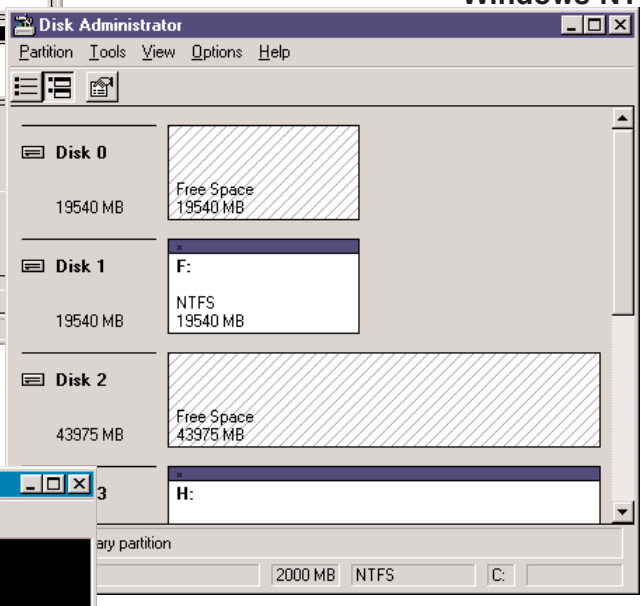
4. CREATING/NAMING PARTITIONS

The creating and naming of partitions is something done within the Windows operating system. And while Windows XP/2000 and Windows NT both use the Disk Management window, there are enough nuances that make it important to follow the procedure specifically for the appropriate operating system. The procedure for Windows 98/Me is significantly different than the others.

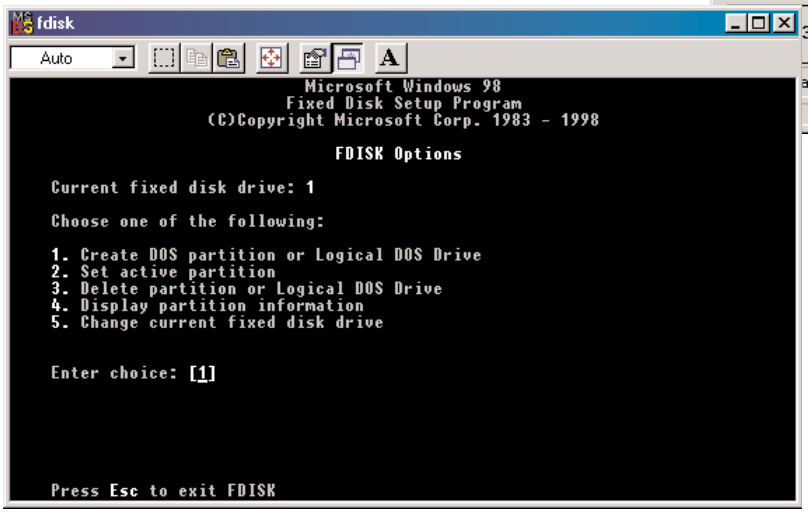
Windows XP/2000


Computer Management
Action View
Volume Layout Type File System Status Capacity
SYSTEM DISK (C:) Partition Basic FAT Healthy (System) 3.73 GB
Disk 0 Basic 19.08 GB Online
19.08 GB Unallocated
Disk 1 Basic 19.07 GB Online
19.07 GB Unallocated
Disk 2 Basic 19.08 GB Online
19.08 GB Unallocated
Disk 3 Basic 3.73 GB Online
SYSTEM DISK (C:) 3.73 GB FAT Healthy (System)
CDRom 0 CDRom (D:) Online
Unallocated Primary Partition

Windows NT


Disk Administrator
Partition Tools View Options Help
Disk 0 19540 MB Free Space 19540 MB
Disk 1 19540 MB F: NTFS 19540 MB
Disk 2 43975 MB Free Space 43975 MB
H:
2000 MB NTFS C:

Windows 98/Me


fdisk
Auto
Microsoft Windows 98
Fixed Disk Setup Program
(C)Copyright Microsoft Corp. 1983 - 1998
FDISK Options
Current fixed disk drive: 1
Choose one of the following:
1. Create DOS partition or Logical DOS Drive
2. Set active partition
3. Delete partition or Logical DOS Drive
4. Display partition information
5. Change current fixed disk drive
Enter choice: [1]
Press Esc to exit FDISK

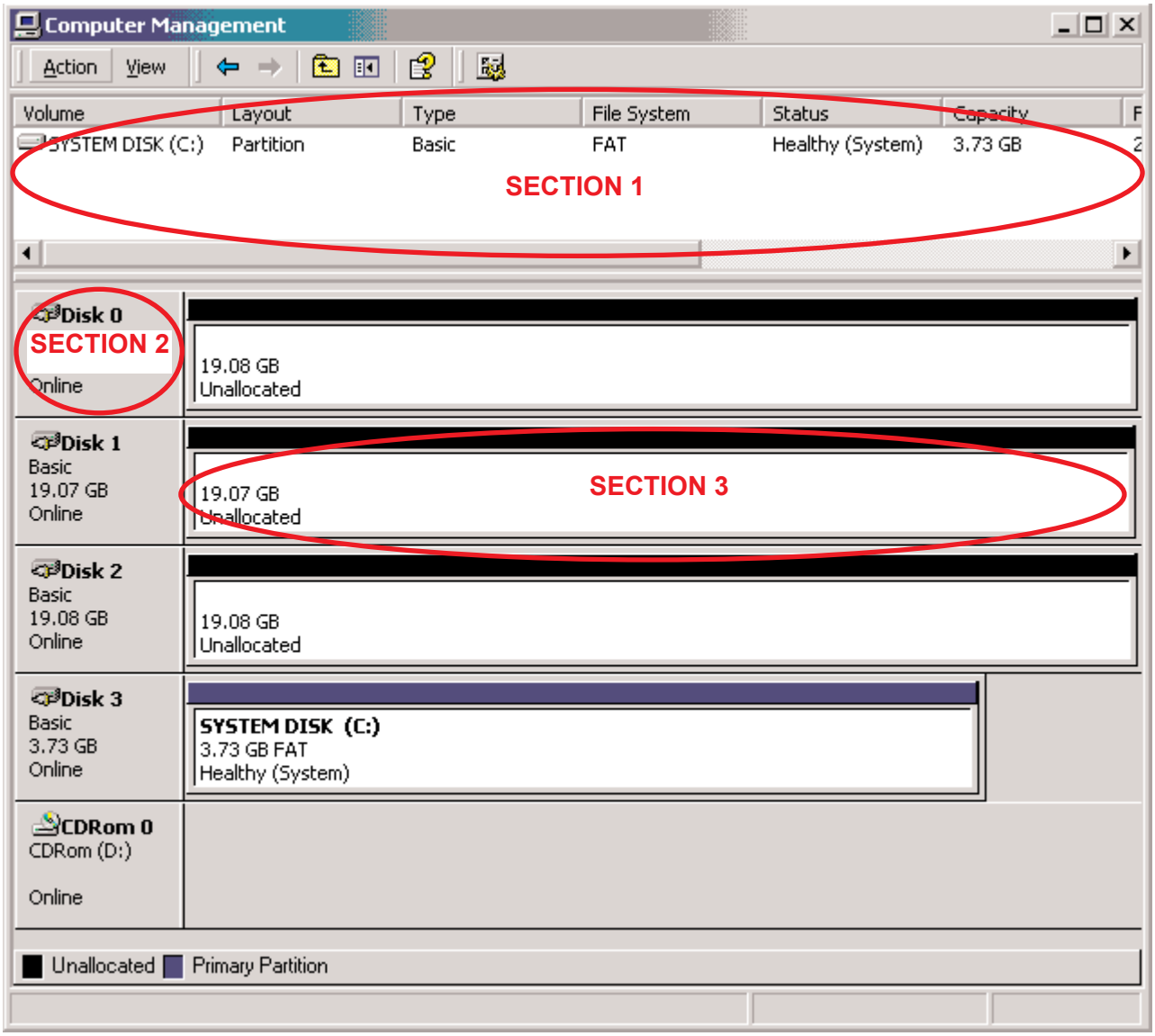
Windows XP/2000 Operating System

Before creating any partitions, RAID sets must first be created/dissolved using the BIOS RAID Utility. Once completed, continue booting Windows.

Once Windows is running, open the Disk Management window located at:

Control Panel ▸ Administrative Tools ▸ Computer Management ▸ Storage ▸ Disk Management

Something similar to the following window should appear:



This window has three main sections:

SECTION 1: System listing of all formatted and available disks/RAID Sets.
SECTION 2: Report of physical connection of disks/RAID Sets.
SECTION 3: Report of partition status, disk letter, and volume name.

Initial Window

In **SECTION 2**, every disk should report as:

Basic
Disk Size (the actual available disk space will be reported here)
Online

Instead of "**Basic**," a disk may also report as either "Unknown" or "Dynamic."

If the disk reports as "Unknown," right-click on the disk (**SECTION 2**) and click on **Write Signature**.

At this point, a window will appear with the disk in question (all "Unknown" disks may appear in this window). Make sure the box next to each disk is checked, then click OK.

The disk should now report as "**Basic**."

If a disk reports as "**Dynamic**," right-click on **SECTION 2** of that disk, and click on "**Return disk to Basic...**" Within seconds the disk should report as **Basic**.

Creating Partitions

In **SECTION 2**, the disk order corresponds directly to the order the Sets appear in the BIOS. Therefore, the first Unallocated Partition represents Set 1, and so on.

1. At this point, there should be three disks with Unallocated partitions. Right-click on the partition of the first disk and click on "Create Partition." The "Create Partition Wizard" should appear.

    1. The first window is an introductory window to the Wizard. Click **Next**.

    2. The second window designates the partition as a primary partition. Click **Next**.

    3. The third window designates the partition size. Since this is a Striped RAID set, utilizing 2 disk drives, the size of the partition should be approximately double the size of a single disk drive (assuming all disks are of identical size). Click **Next**.

    4. The fourth window designates the drive letter of the partition.

5. The fifth window allows the user to label the volume name, and choose the type of formatting to take place upon the creation of the partition. Choose which ever drive letter is desired (the lowest possible value is automatically entered), name the volume whatever is desired (suggestions being something generic such as STRIPED SET or something specific to use such as FINANCIAL, CRITICAL, MISCELLANEOUS, etc.) then check the box next to “quick format.” Click **Next**.

6. The sixth window is a summary window listing all of the selections made. Click **Finish**.

Depending on the size of the disk drive(s) included in the partition, the partition should change from “Unallocated” to “Healthy” with its name and drive letter reported as well in a matter of minutes or less. Do not attempt to create a partition for the next disk until the disk currently being formatted is complete and reports **Healthy**.

Also note that once the disk reports Healthy, it appears in the listing in **SECTION 1** with all of its pertinent information as well.

2. Repeat this procedure for the partition of the second and third disk.

3. Close the Data Management window by clicking on the small boxed “X” in the top right corner of the window.

4. Click on the “My Computer” icon on the Desktop. The three new drives should now be visible and properly named. Data may now be stored to each of these disks if desired.

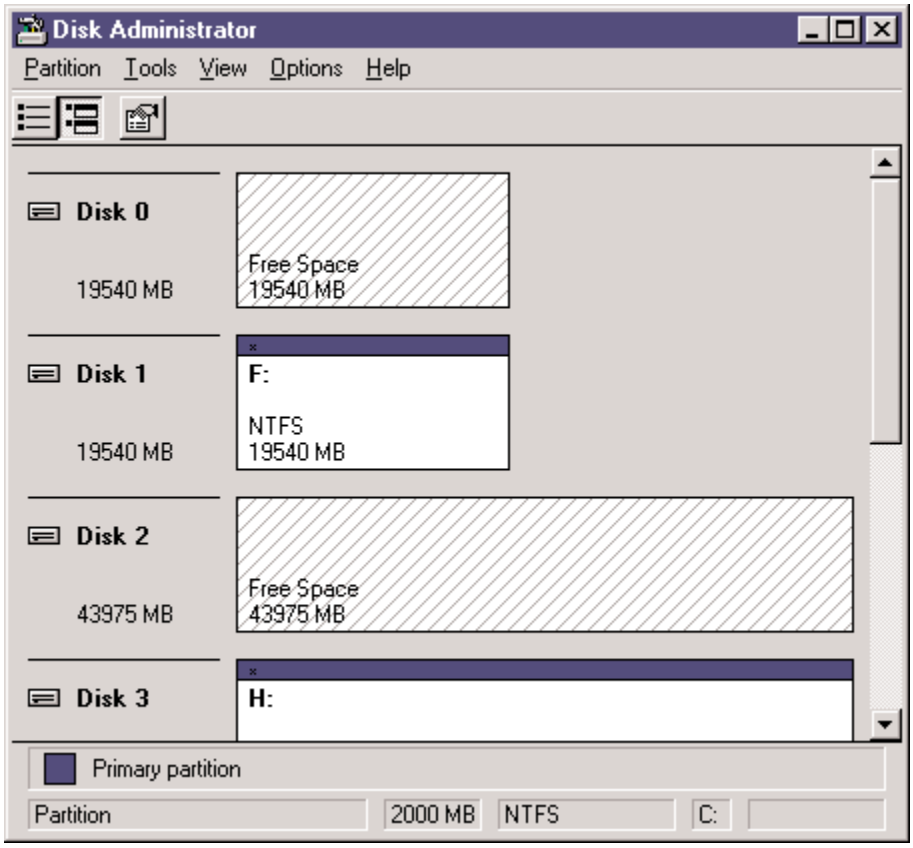
Windows NT Operating System

Before creating any partitions, RAID sets must first be created/dissolved using the BIOS RAID Utility. Once completed, continue booting Windows.

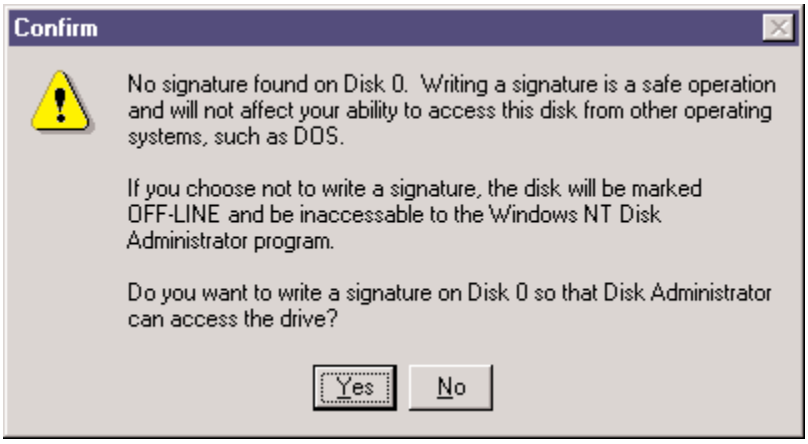
Once Windows is running, open the **Disk Administrator** window. The **Disk Administrator** window is located at:

Start ▸ Programs ▸ Disk Administrator (Common)

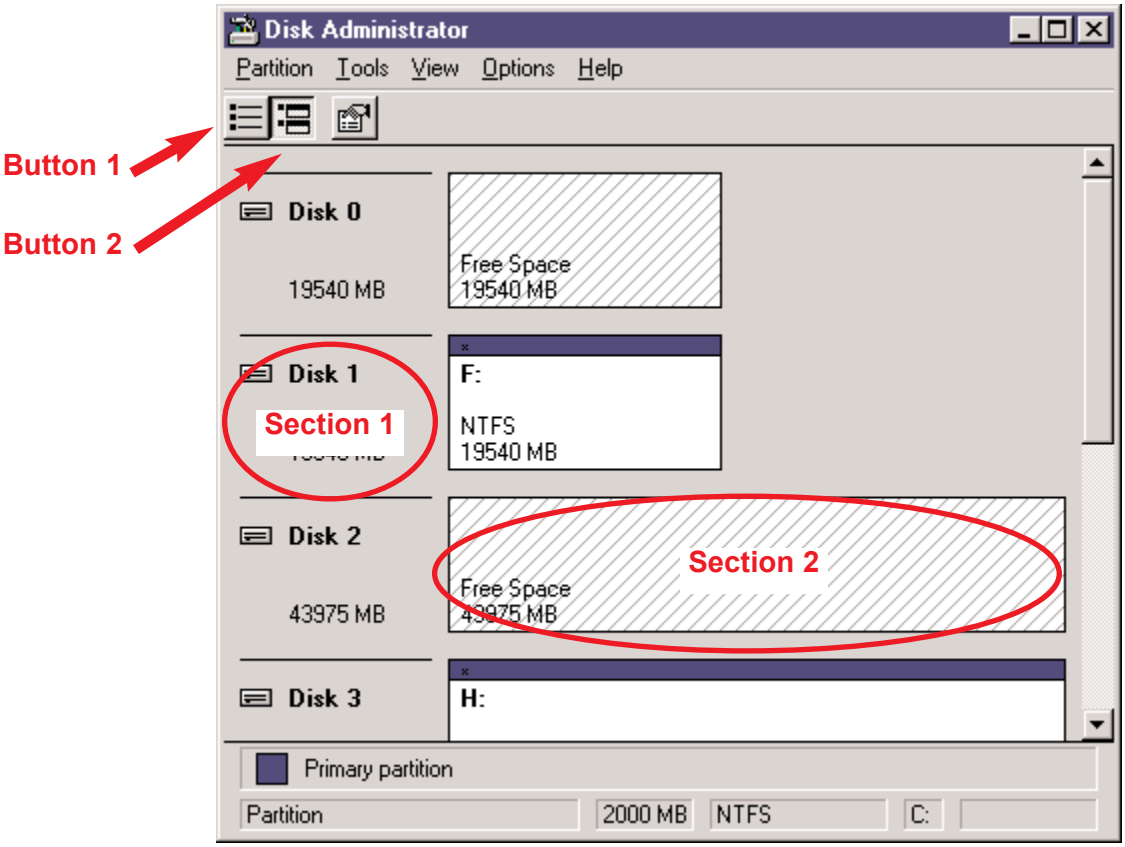
Something similar to the following window should appear:



However, this **Write Signature** window may appear first:


Confirm
No signature found on Disk 0. Writing a signature is a safe operation and will not affect your ability to access this disk from other operating systems, such as DOS.
If you choose not to write a signature, the disk will be marked OFF-LINE and be inaccessable to the Windows NT Disk Administrator program.
Do you want to write a signature on Disk 0 so that Disk Administrator can access the drive?
Yes
No

If so, answer **YES** for each disk reported with no signature found. Afterwards, something similar to the following should appear:



Button 1 opens the Disk Administrator Volumes window which lists the recognizable Volumes, their capacity, free space, type of format, etc.

Button 2 opens the Disk Configuration window (shown above), detailing all disks (or RAID Sets), partitions, and allows he suer to format and name each partition and volume.

Section 1 reports the size of each disk (or RAID Set).

Section 2 reports on each partition, and allows the user to format or delete partitions.

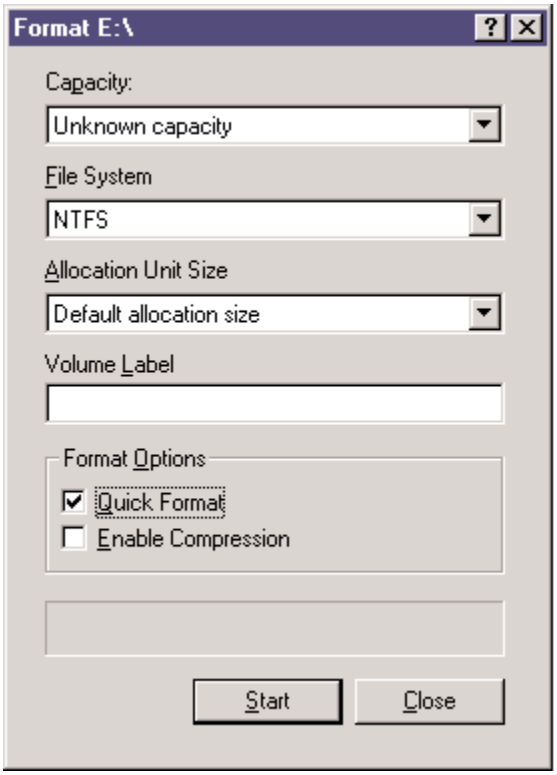
Creating Partitions

1. If any disk (besides the SYSTEM DISK) appear to be formatted, right click on that partition (Section 2) and select **Delete**.

WARNING: Be sure to identify the System Disk, that which has the Operating System installed on it. This disk should always report correctly. ***NEVER*** **CHANGE OR DELETE THIS DISK OR PARTITION.**

2. Once all disks are reporting as Free Space, right-click on each partition and select **Create...**
3. A **Create Primary Partition** window should now appear. Click **OK**.
4. Click **Confirm**.
5. Repeat this step for each disk.
6. Now, right-click on the first disk and select **Mark Active**.
7. A window will appear stating that this will take place on the next reboot. Click **OK**.
8. Repeat this step for each disk.
9. Close window. Confirm saving changes. Click **Yes**.
10. Disk Administrator will report that the disks were updated successfully. Click **OK**.
11. Re-open **Disk Administrator**.
12. Right-click on the first disk (this should now be the Striped Set).
13. Select **Format...**

Something similar to the following window should appear:



14. While **Capacity** can not be changed, make sure that **File System** has **NTFS** selected, don't change **Default Allocation Size**, and since it is the Striped Set that is being formatted, enter **Striped Set** for **Volume Label**. Make sure that **Quick Format** is selected as the **Format Option**.

15. Repeat this procedure for the other two disks, but name them something else.

16. Close **Disk Administrator** and open **My Computer** (icon should be on Desktop).

17. The new disks should now appear in **My Computer** window.

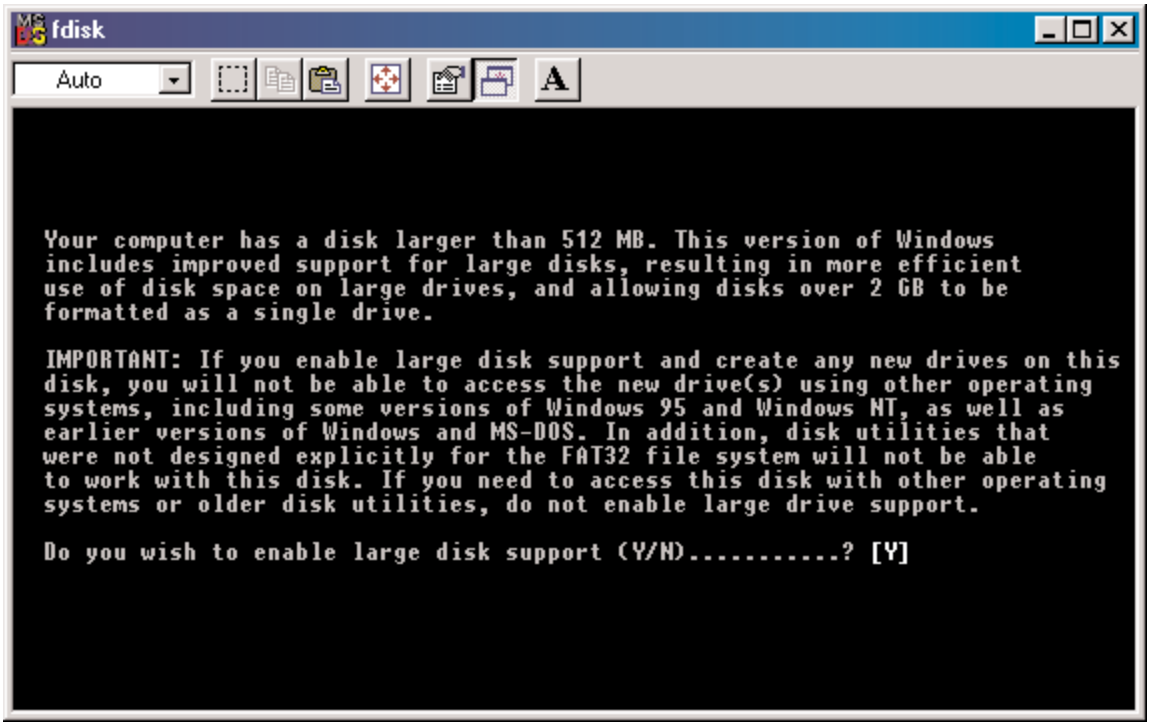
18. Close all windows and applications and **Restart** computer.

Windows 98/Me Operating System

Windows 9x does not have a Disk Administrator or Disk Management window. Instead, after creating RAID sets using the BIOS RAID utility and booting Windows, start fdisk by:

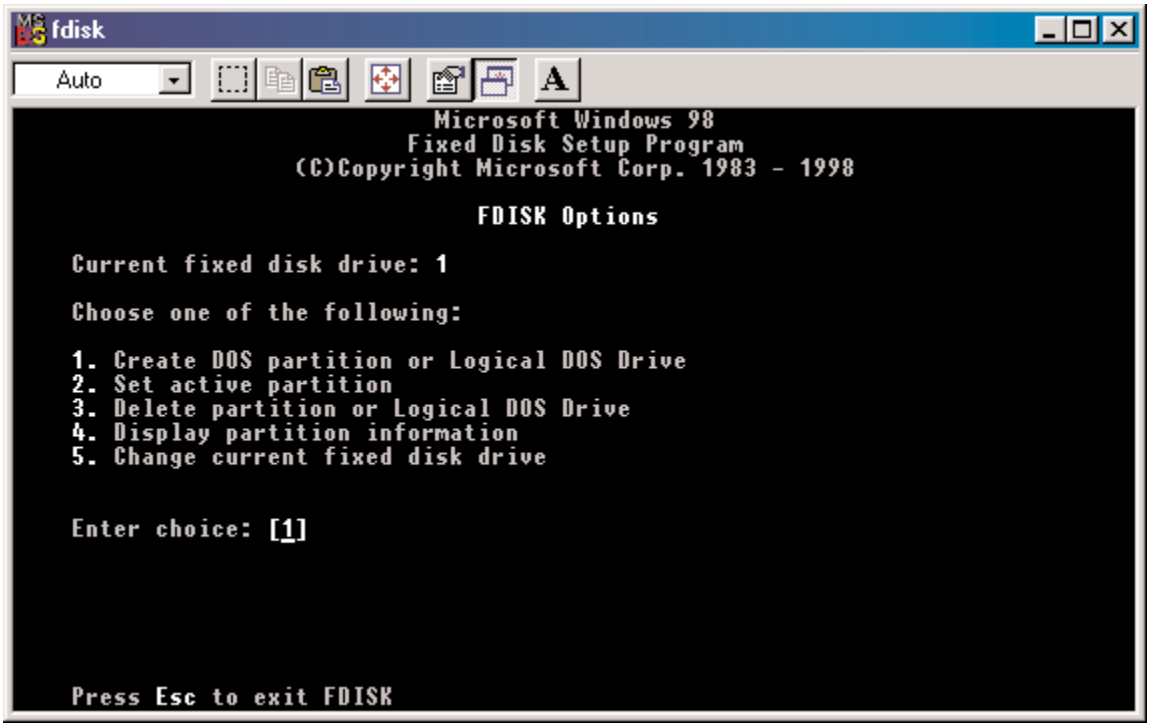
1. Click on the **START** button
2. Select **Run...**
3. Type **fdisk**
4. Click **OK**

The following window will probably appear:

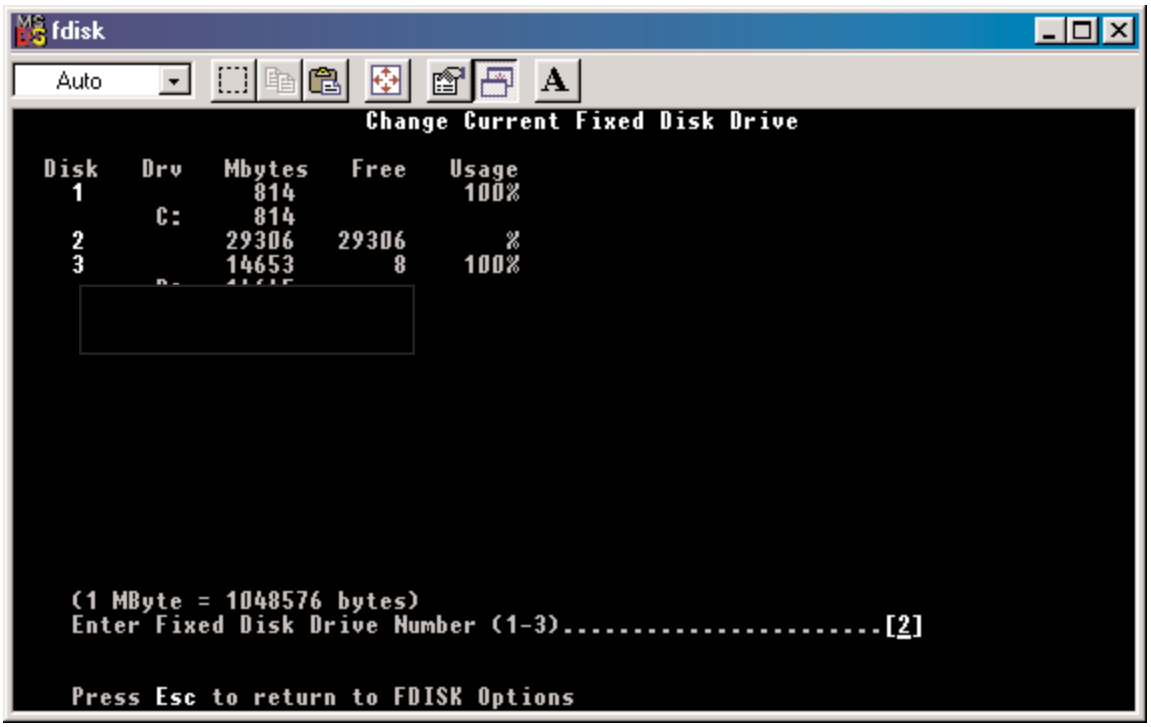

fdisk
Auto
Your computer has a disk larger than 512 MB. This version of Windows includes improved support for large disks, resulting in more efficient use of disk space on large drives, and allowing disks over 2 GB to be formatted as a single drive.
IMPORTANT: If you enable large disk support and create any new drives on this disk, you will not be able to access the new drive(s) using other operating systems, including some versions of Windows 95 and Windows NT, as well as earlier versions of Windows and MS-DOS. In addition, disk utilities that were not designed explicitly for the FAT32 file system will not be able to work with this disk. If you need to access this disk with other operating systems or older disk utilities, do not enable large drive support.
Do you wish to enable large disk support (Y/N).....? [Y]

Press **Enter** for yes.

The **FDISK Options** window will appear:

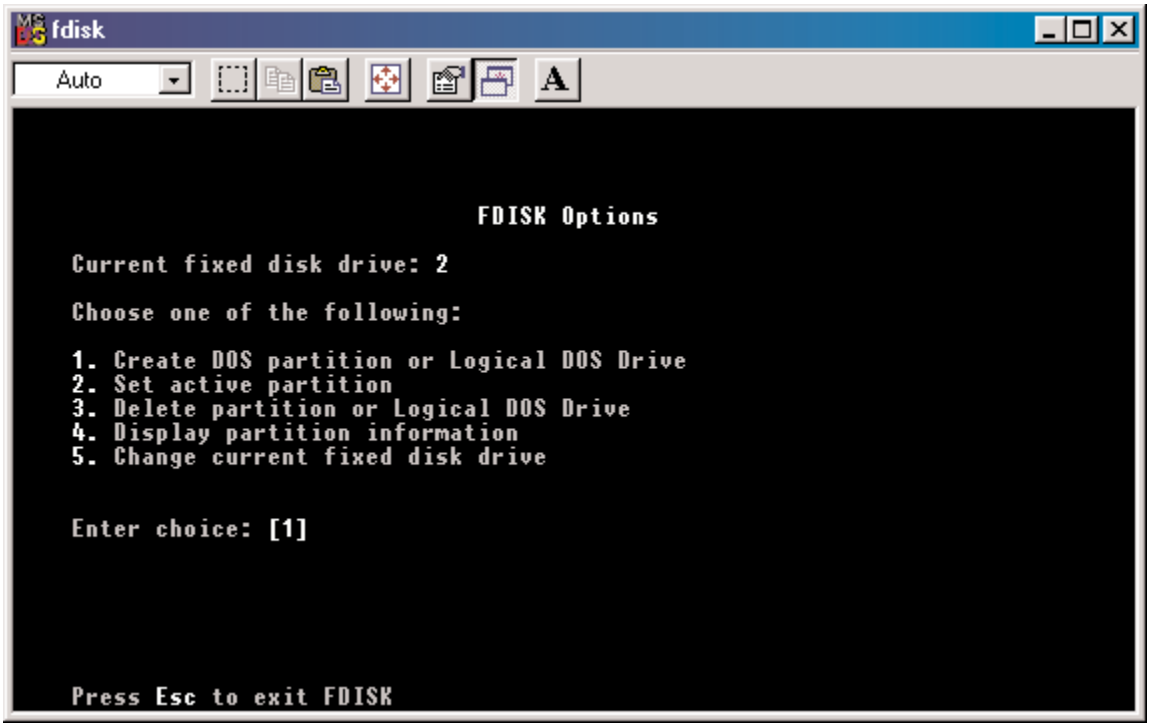

fdisk
Auto
Microsoft Windows 98
Fixed Disk Setup Program
(C)Copyright Microsoft Corp. 1983 - 1998
FDISK Options
Current fixed disk drive: 1
Choose one of the following:
1. Create DOS partition or Logical DOS Drive
2. Set active partition
3. Delete partition or Logical DOS Drive
4. Display partition information
5. Change current fixed disk drive
Enter choice: [1]
Press Esc to exit FDISK

The Current Fixed Drive will be the System Drive (normally C:\). In order to create partitions, the fixed drive needs to be changed. Select **5** and press **Enter**.

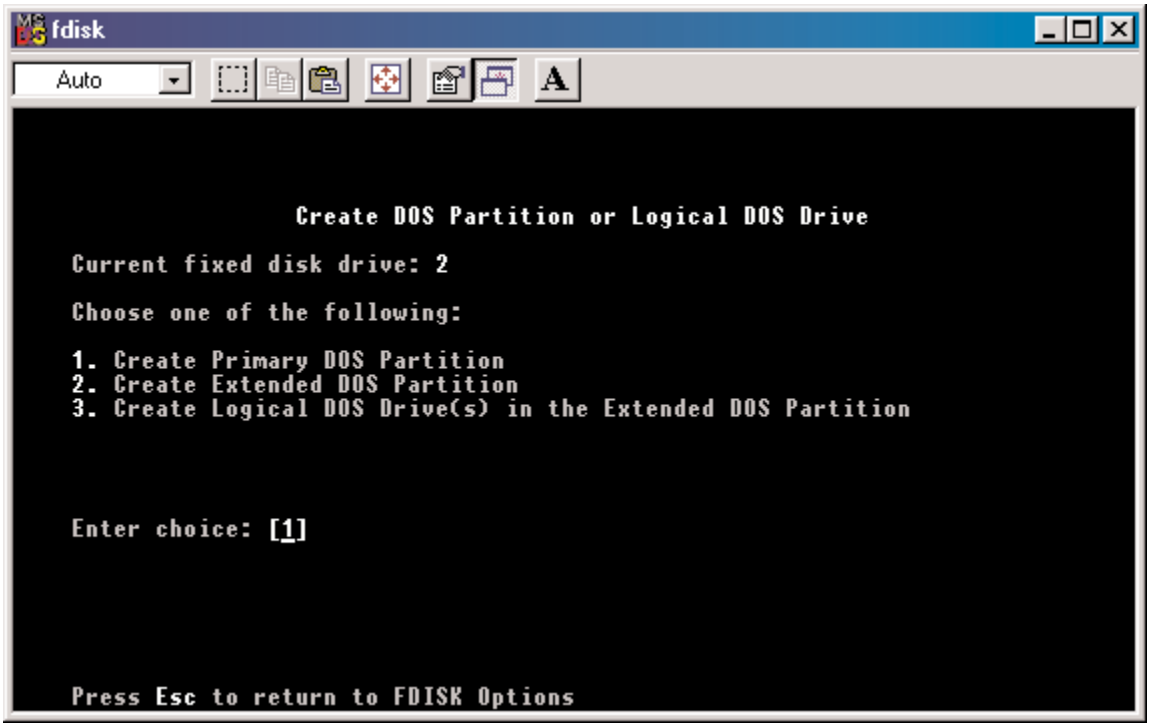


Enter the disk number to partition and press **Enter**.

With the Current fixed drive set at the disk needing to be partitioned, Select **1** and press **Enter**.

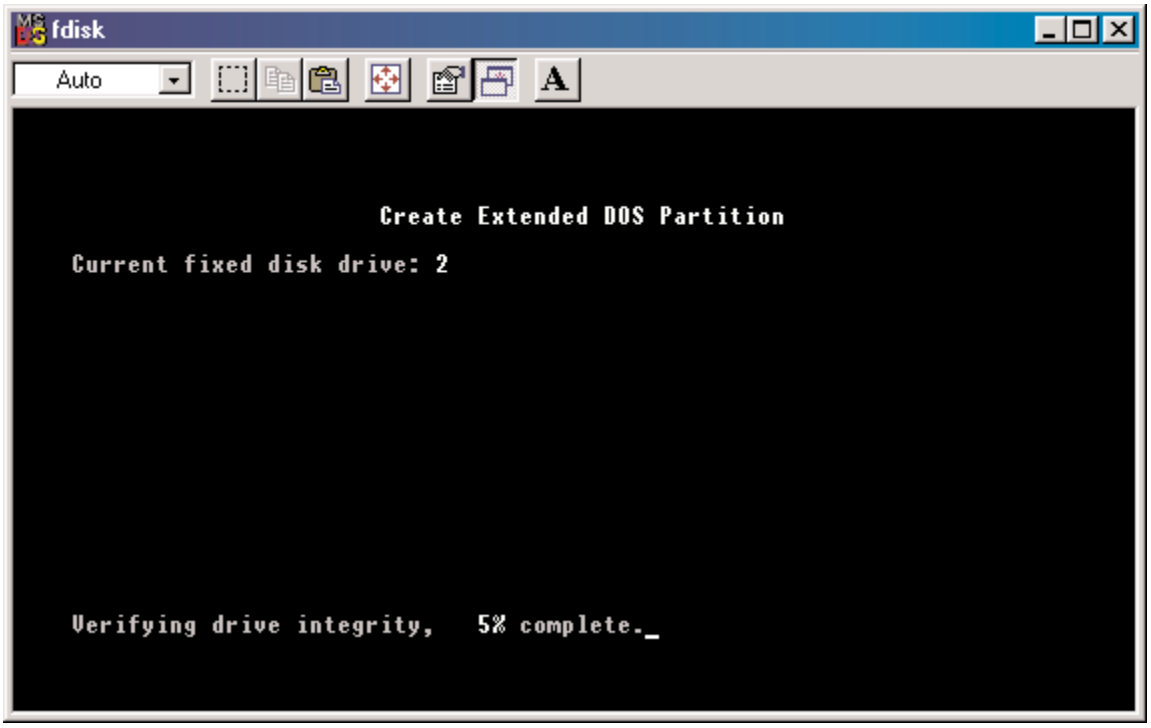

fdisk
Auto
FDISK Options
Current fixed disk drive: 2
Choose one of the following:
1. Create DOS partition or Logical DOS Drive
2. Set active partition
3. Delete partition or Logical DOS Drive
4. Display partition information
5. Change current fixed disk drive
Enter choice: [1]
Press Esc to exit FDISK

The following window will appear:

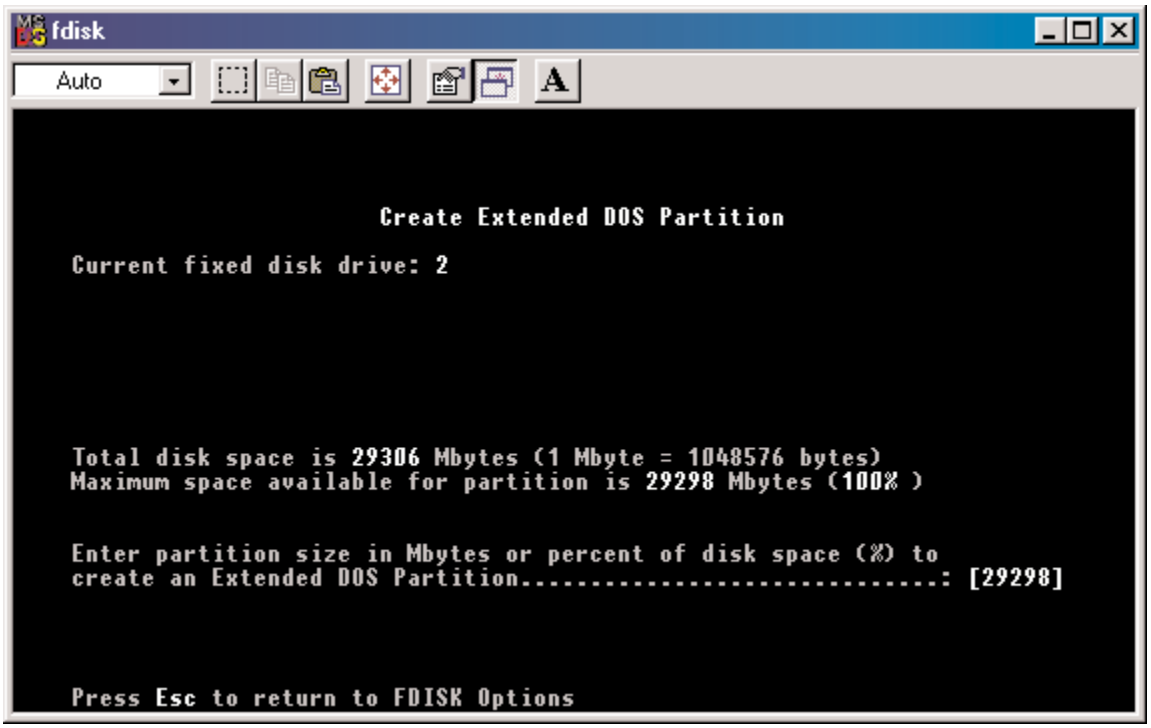

fdisk
Auto
Create DOS Partition or Logical DOS Drive
Current fixed disk drive: 2
Choose one of the following:
1. Create Primary DOS Partition
2. Create Extended DOS Partition
3. Create Logical DOS Drive(s) in the Extended DOS Partition
Enter choice: [1]
Press Esc to return to FDISK Options

Select **2** to create an extended partition and press **Enter**.

The following window will appear:

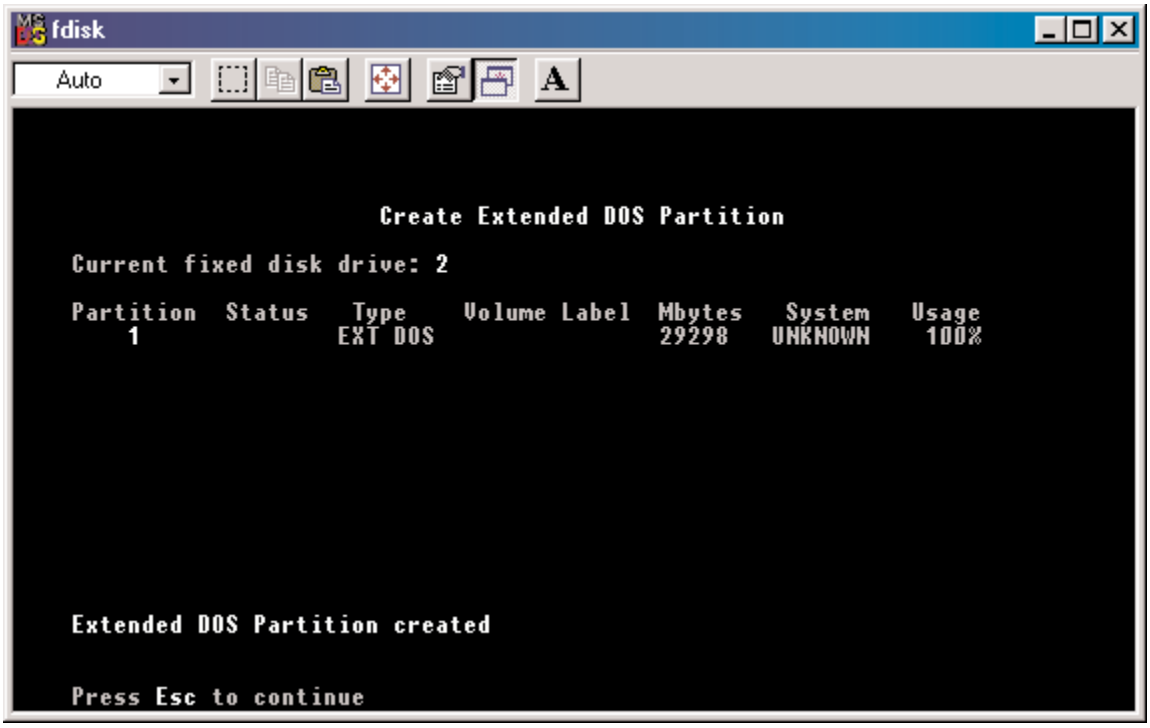


Once the percentage counter reaches 100%, the following window will appear:

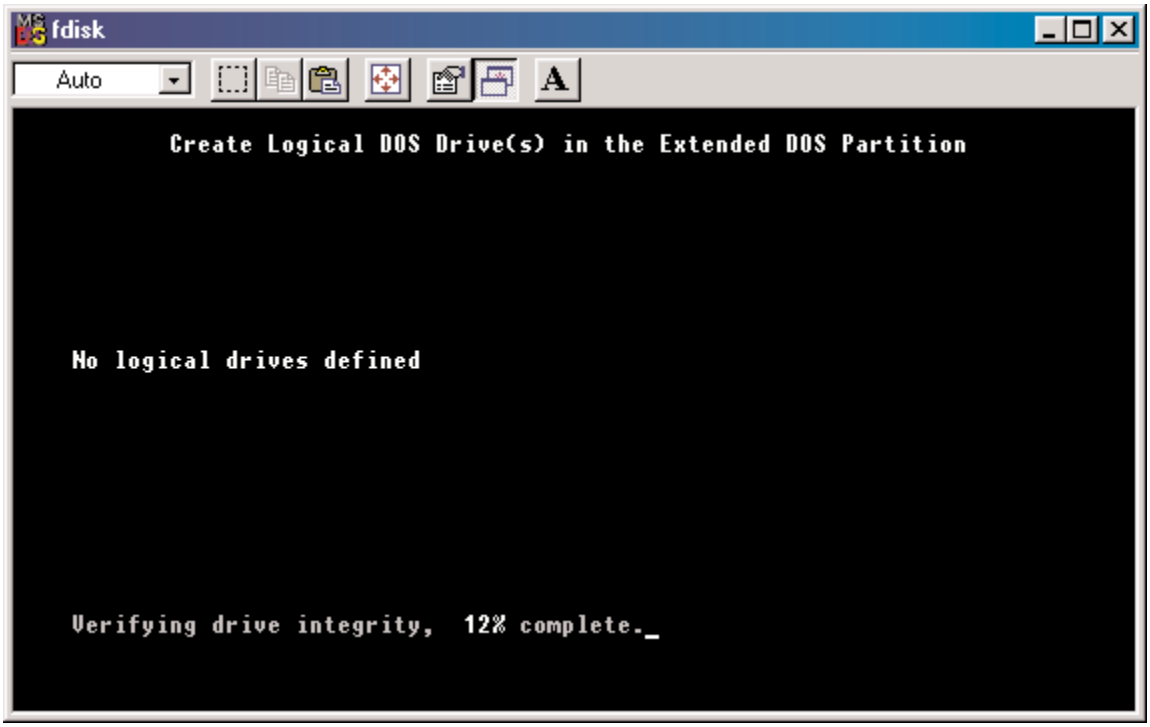

fdisk
Auto
Create Extended DOS Partition
Current fixed disk drive: 2
Total disk space is 29306 Mbytes (1 Mbyte = 1048576 bytes)
Maximum space available for partition is 29298 Mbytes (100%)
Enter partition size in Mbytes or percent of disk space (%) to
create an Extended DOS Partition.....: [29298]
Press Esc to return to FDISK Options

This window explains how much space will be available in the partition. Press **Enter**.

This window shows that the partition has been created. Press **Esc**.

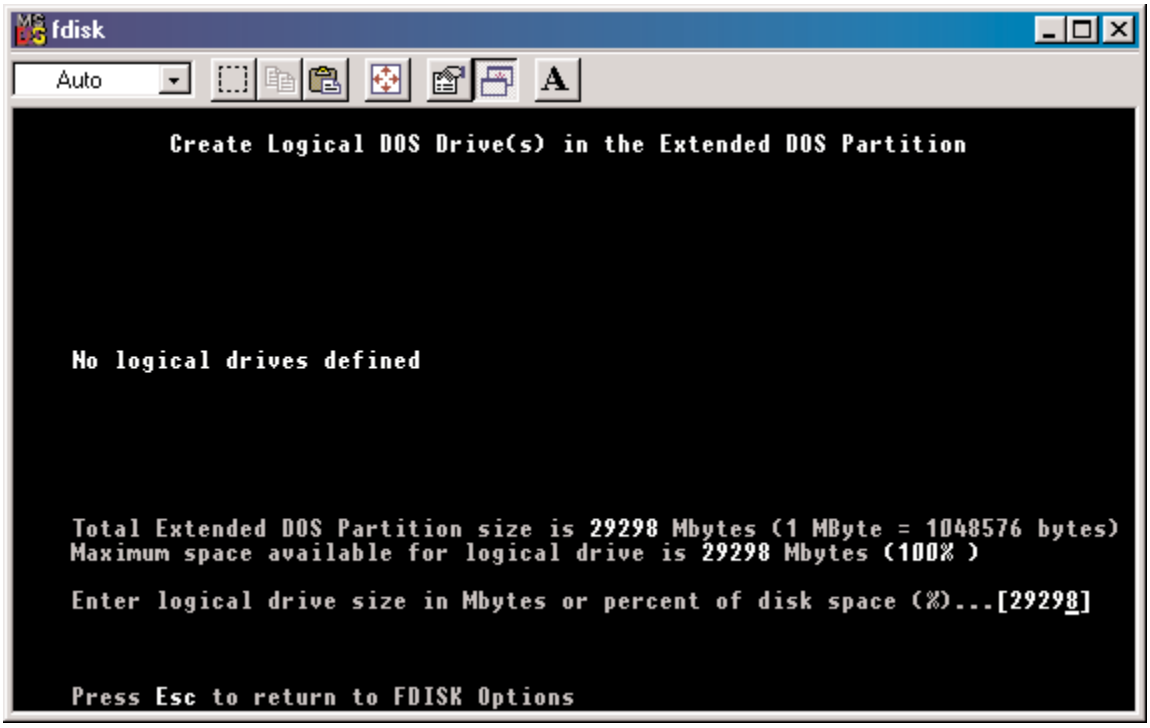

fdisk
Auto
Create Extended DOS Partition
Current fixed disk drive: 2
Partition Status Type Volume Label Mbytes System Usage
1 EXT DOS 29298 UNKNOWN 100%
Extended DOS Partition created
Press Esc to continue

FDISK is now creating a logical drive.

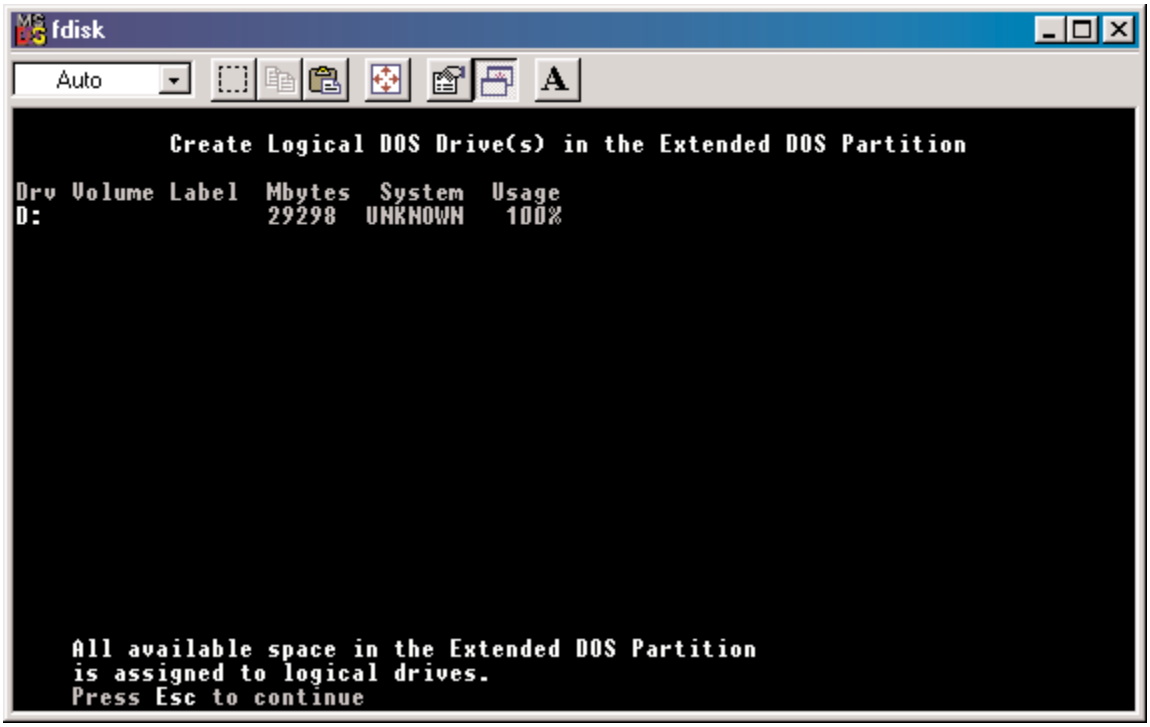

fdisk
Auto
Create Logical DOS Drive(s) in the Extended DOS Partition
No logical drives defined
Verifying drive integrity, 12% complete._

Once the percentage counter reaches 100% the following window appears:

Once again, this window reports size.

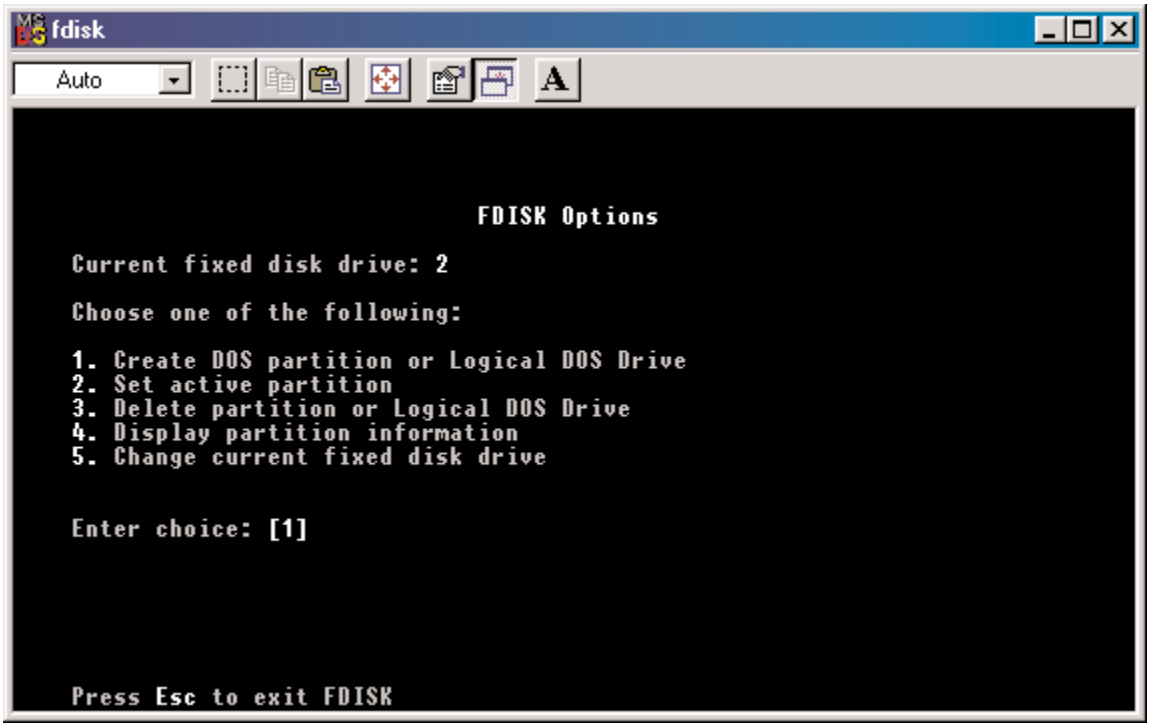

fdisk
Auto
Create Logical DOS Drive(s) in the Extended DOS Partition
No logical drives defined
Total Extended DOS Partition size is 29298 Mbytes (1 MByte = 1048576 bytes)
Maximum space available for logical drive is 29298 Mbytes (100%)
Enter logical drive size in Mbytes or percent of disk space (%)...[29298]
Press Esc to return to FDISK Options

Press **Enter** and the following window appears:

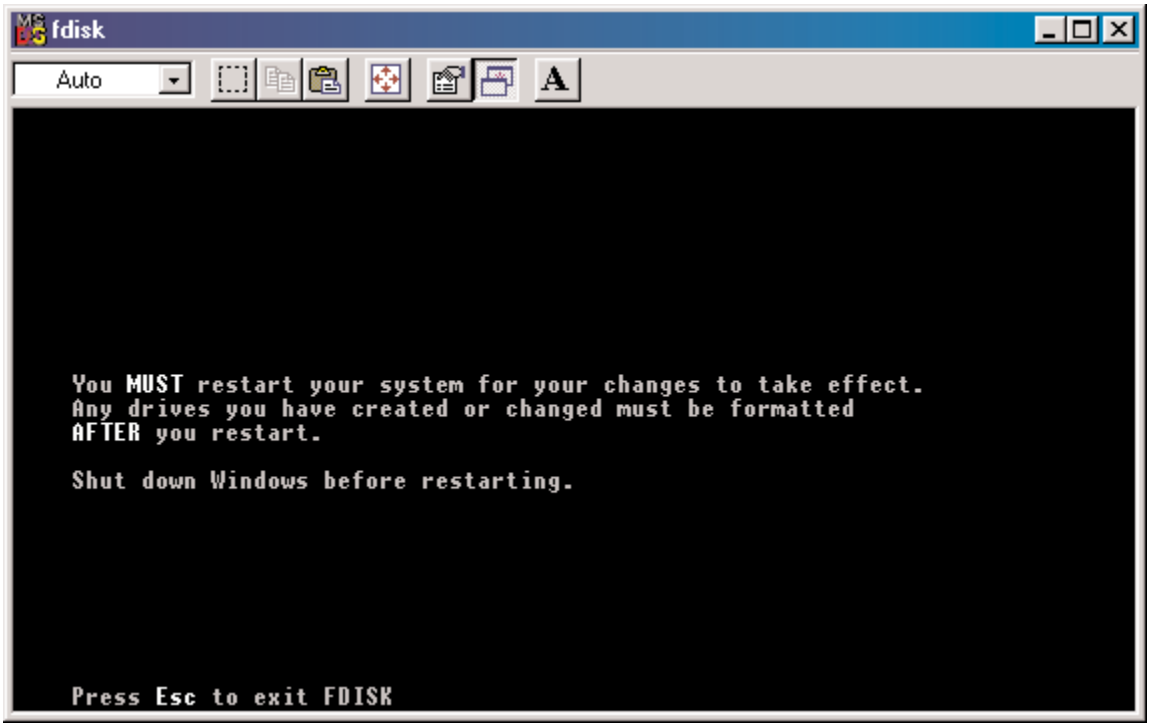

fdisk
Auto
Create Logical DOS Drive(s) in the Extended DOS Partition
Drv Volume Label Mbytes System Usage
D: 29298 UNKNOWN 100%
All available space in the Extended DOS Partition
is assigned to logical drives.
Press Esc to continue

This window now shows the drive and its drive letter and size. Press **Esc**.

If another drive (RAID set) needs to be partitioned, repeat the process, starting by changing the fixed disk drive (Press **5**). If done, press **Esc**.


fdisk
Auto
FDISK Options
Current fixed disk drive: 2
Choose one of the following:
1. Create DOS partition or Logical DOS Drive
2. Set active partition
3. Delete partition or Logical DOS Drive
4. Display partition information
5. Change current fixed disk drive
Enter choice: [1]
Press Esc to exit FDISK

The following window will appear:


fdisk
Auto
You MUST restart your system for your changes to take effect.
Any drives you have created or changed must be formatted
AFTER you restart.
Shut down Windows before restarting.
Press Esc to exit FDISK

This window is a reminder to **RESTART** the computer.

After restarting the computer, and booting Windows 9x, double-click on the **My Computer** icon.

Right-click on each new drive and select **Format**.

Only a **FULL** format will be accepted at this point. Select Full Format, enter the Label Name for the drive or RAID set (if desired) and click **OK**.

Once the drive has been formatted, repeat for each new drive. The new drives should now be ready to be used.

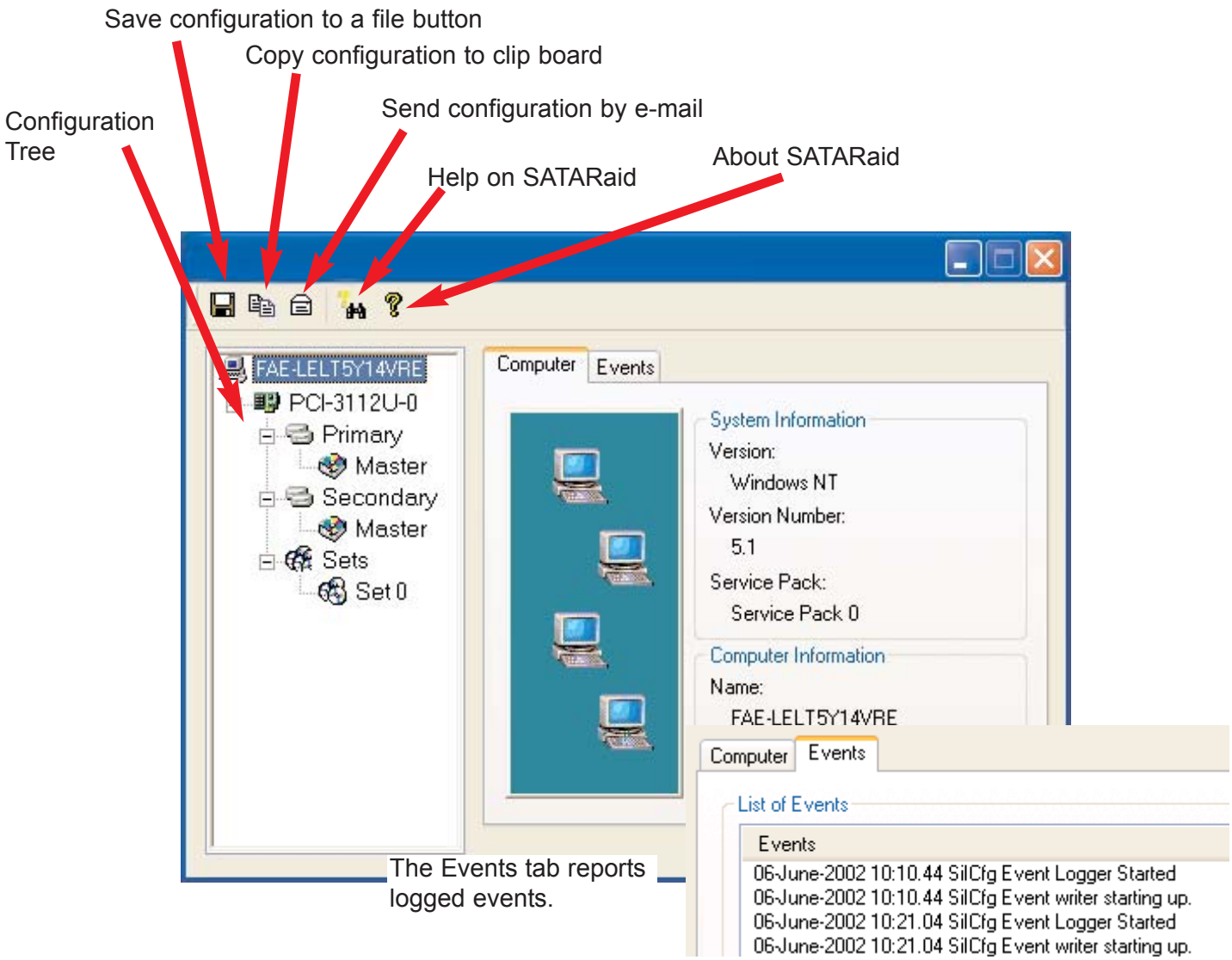
5. USING SILICON IMAGE SATARaid GUI

Overview

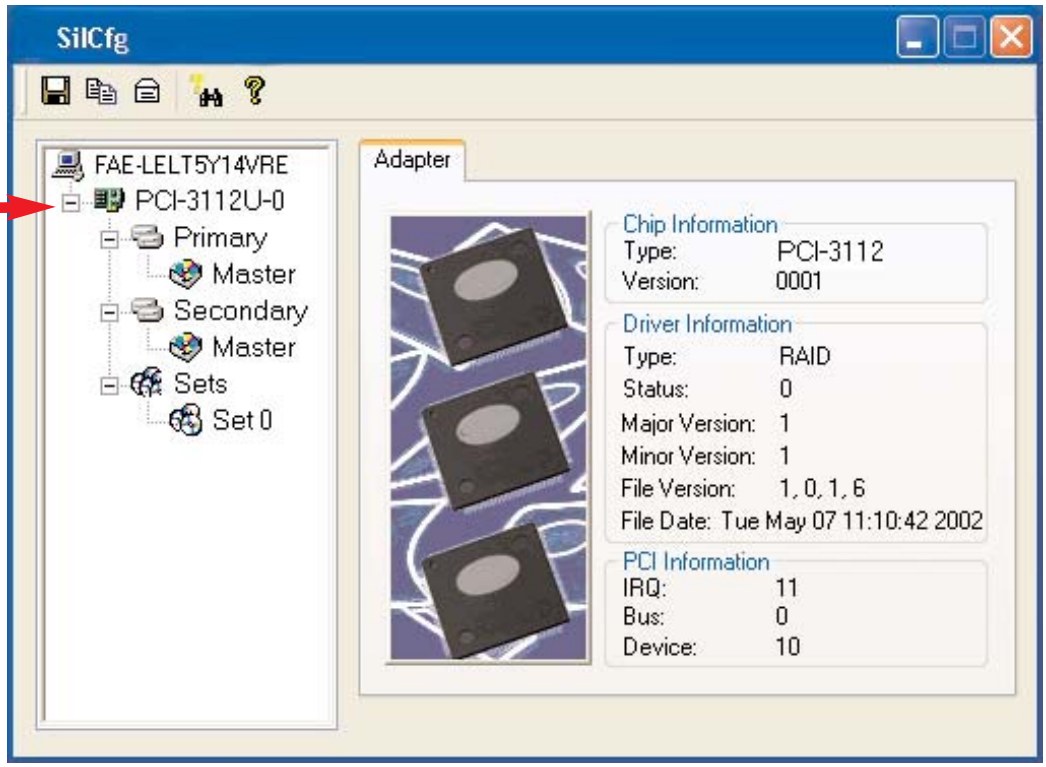
The SATARaid GUI offers the user the ability to easily monitor your RAID Set.

To launch the GUI, simply double-click on the icon located in the bottom right hand corner of the Desktop. If the icon does not appear in the bottom right hand corner of the desktop, find where the application was saved and launch from there.

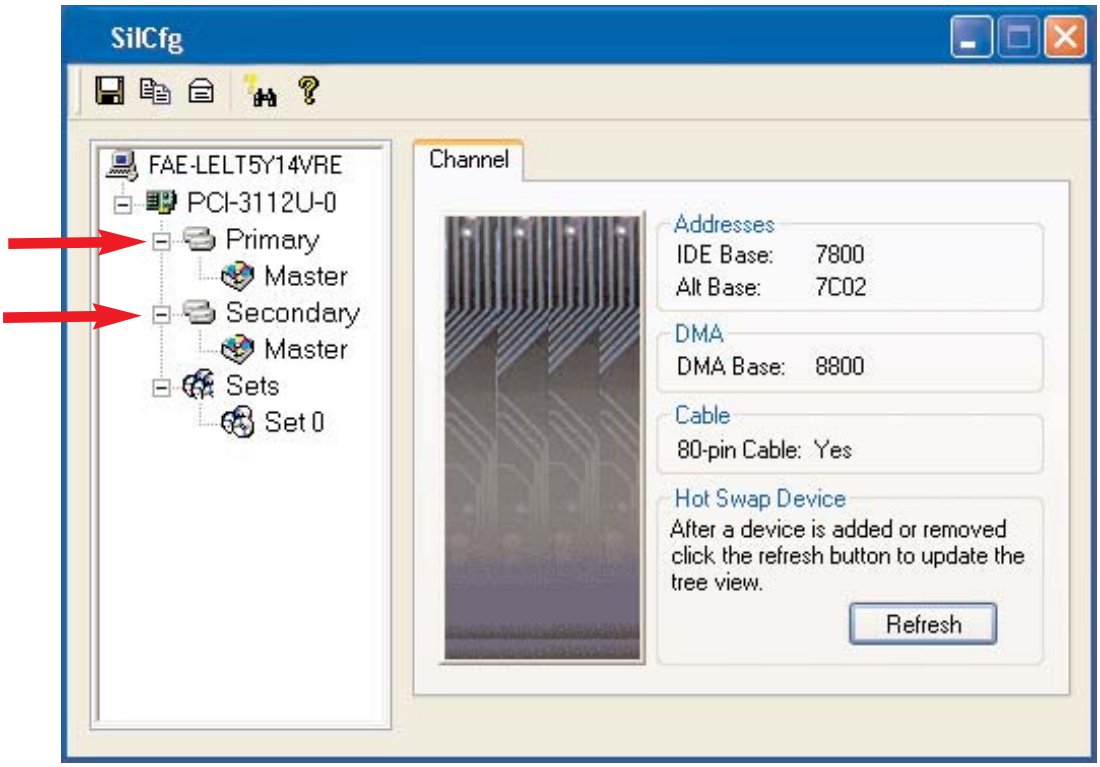
Upon launching the GUI, the the first window which identifies the computer running SATARaid should appear similar to the following:



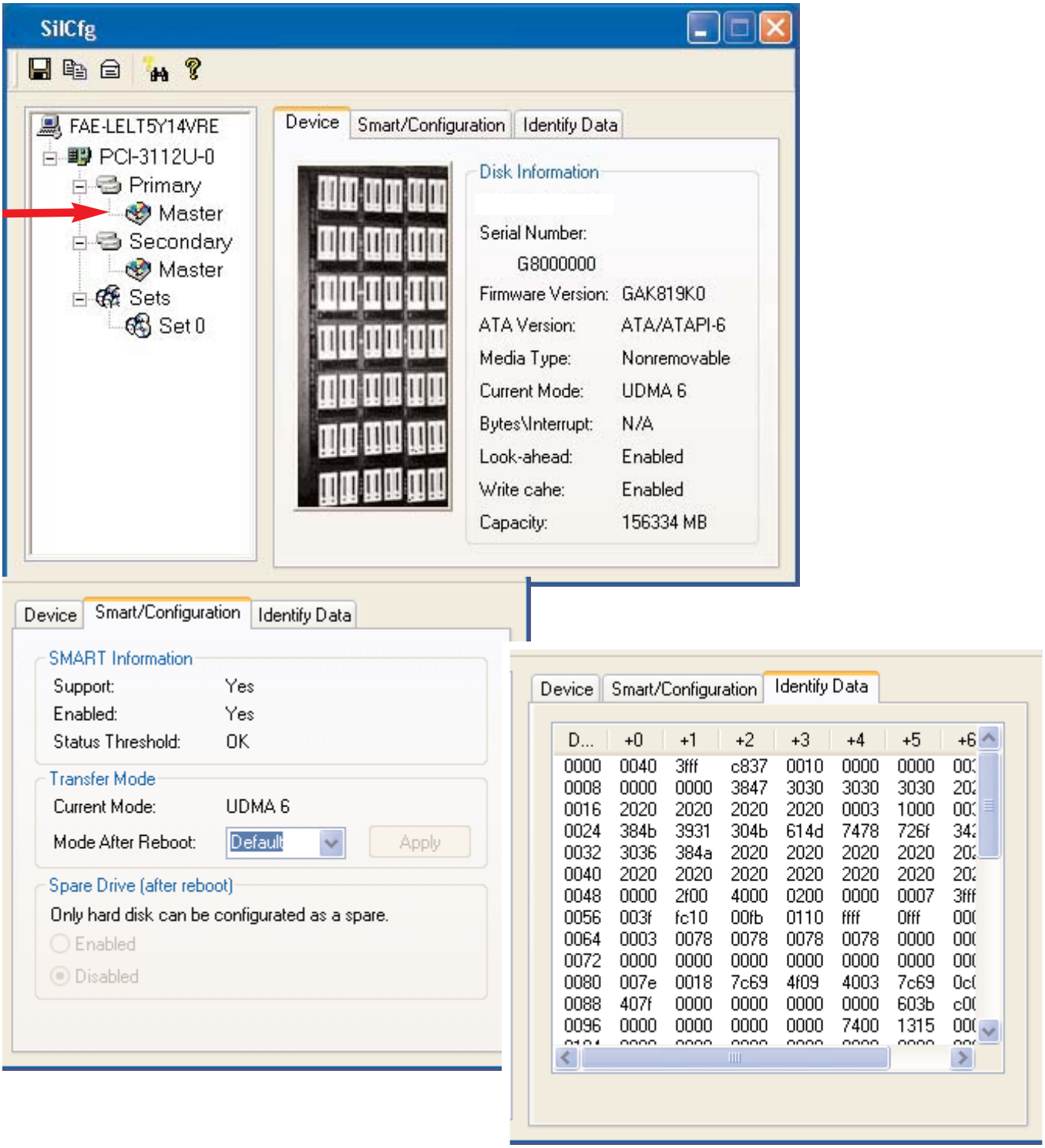
Selecting each different component in the configuration tree provides specific information for that component, such as the chip.



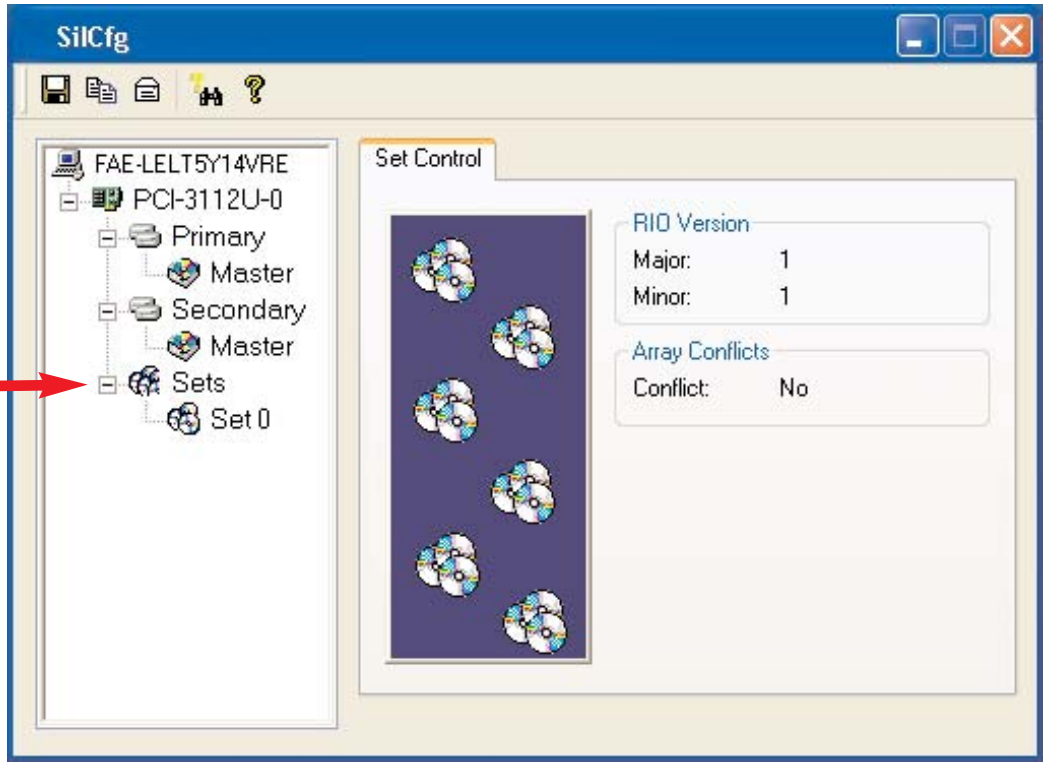
Selecting a specific channel, either Primary or Secondary, the following information is reported:



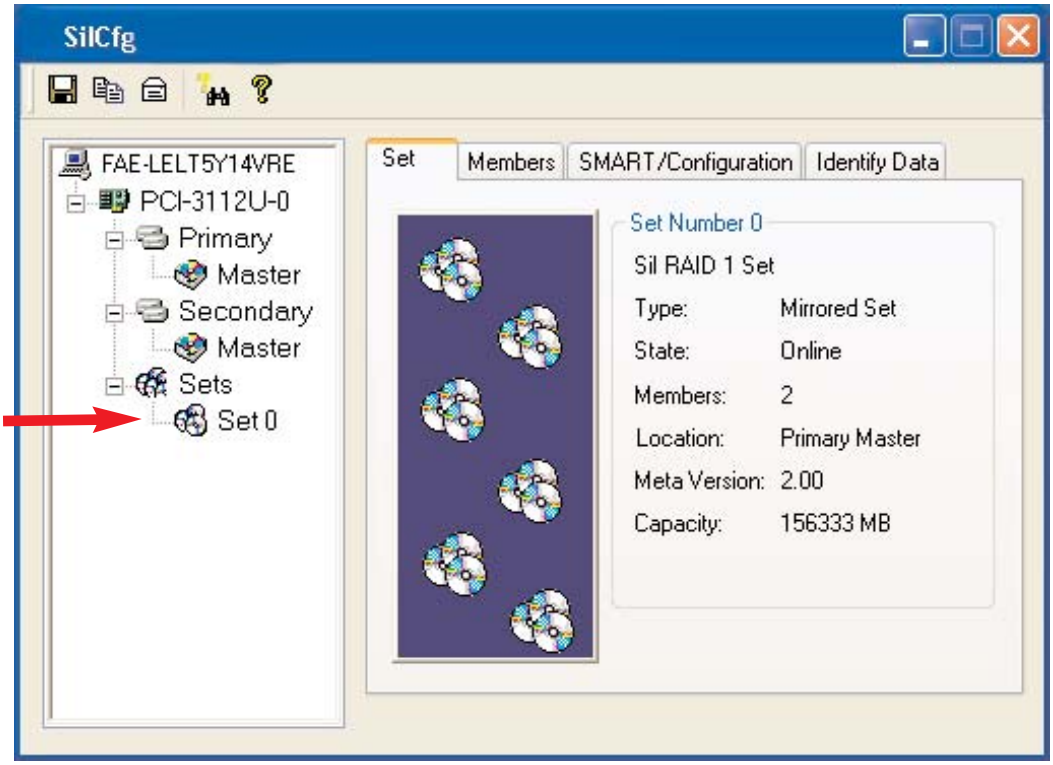
Selecting a specific drive reports all pertinent information to that drive, including Configuration and Disk Identification information.

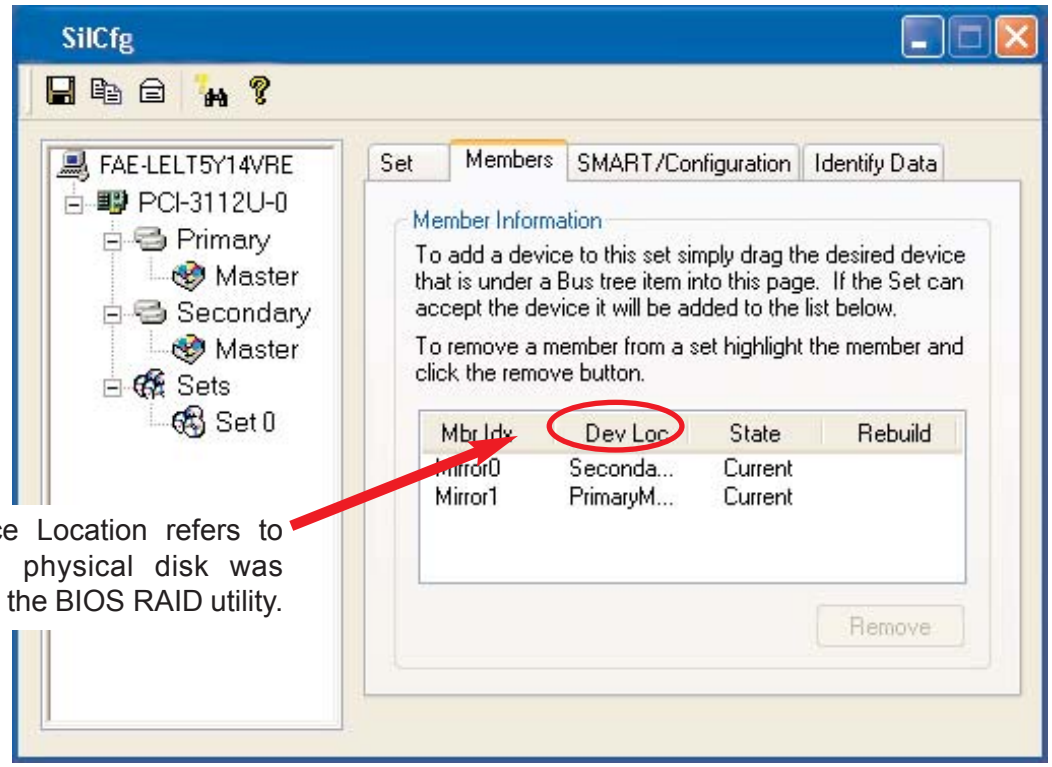


Selecting Sets lists the Sets in the configuration tree and provides information on RIO Version:



By selecting a specific RAID set, such as Set 0, the type of RAID set, the number of members and capacity is reported.



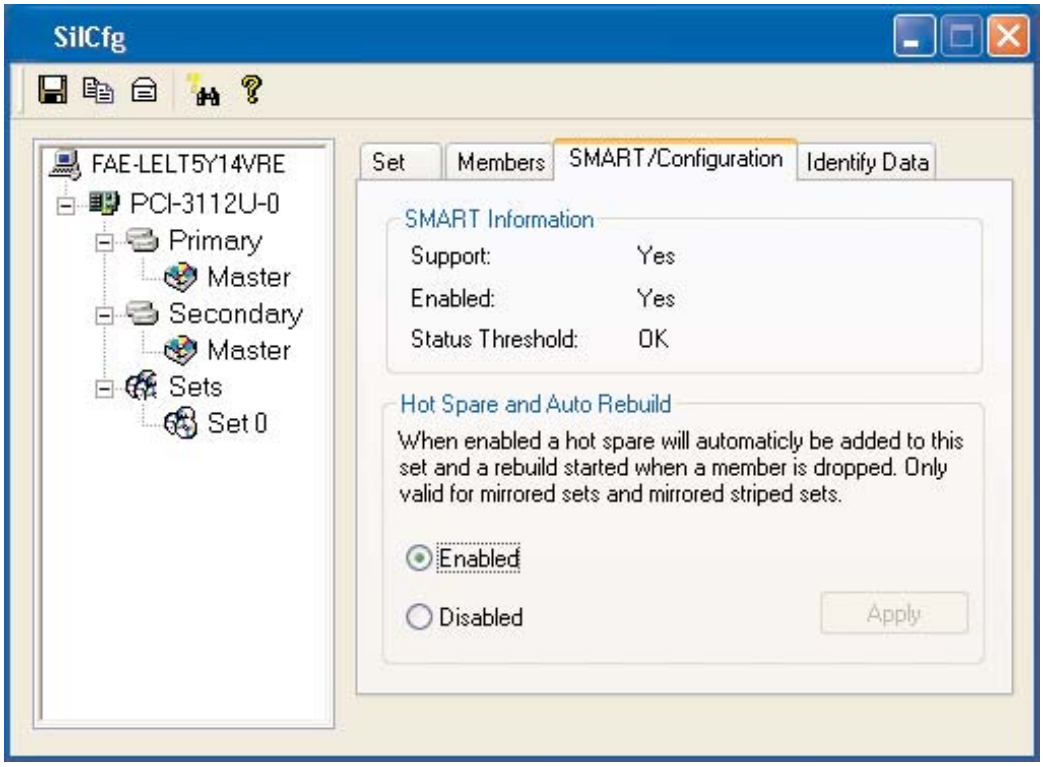


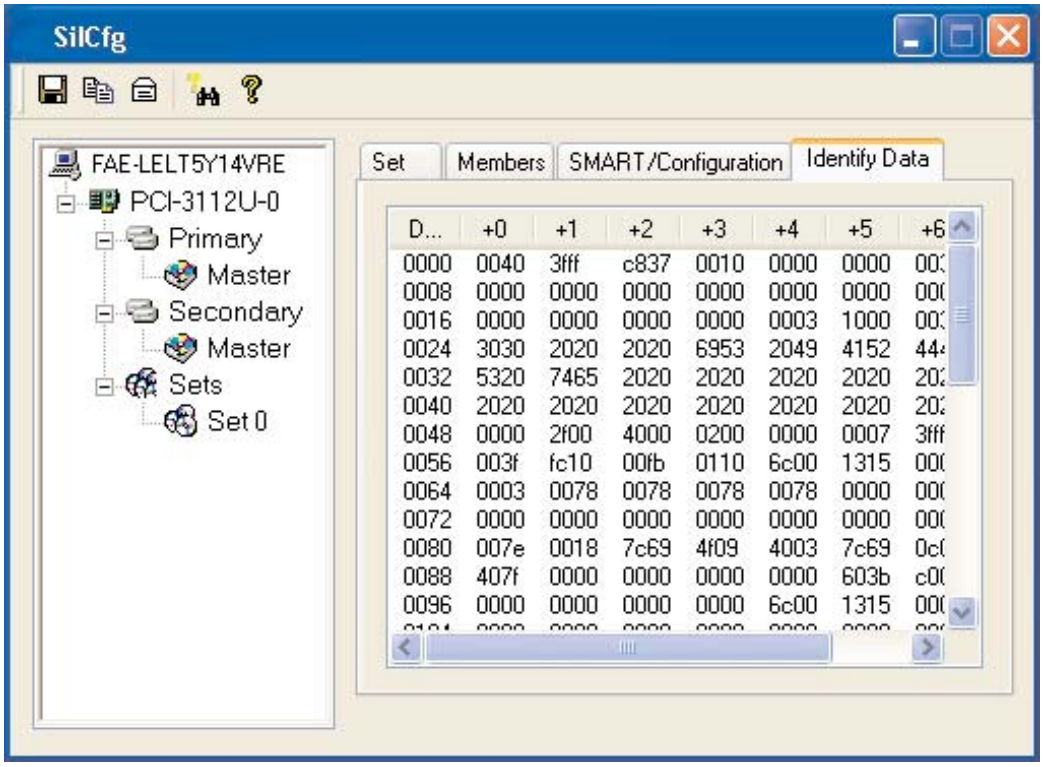
The Device Location refers to how each physical disk was reported in the BIOS RAID utility.

The Members tab of this window reports the device identification (corresponding with the information in the BIOS) and the State of each device.

Besides reporting information, the Members tab of a Mirrored set allows the user to remove a specific drive from that set, as well as add a designated Spare drive to a Mirrored set that has experienced a disk failure. A drive can NOT be removed from a Striped set as this would destroy all data. Note that when a Mirrored Set is first created, the State of the “destination” drive may report as Rebuild for as much as 30-90 minutes depending on the size of the disk.

SMART and Configuration information, as well as Data Identification is again provided for each Set.





SATARaid Configuration Menu

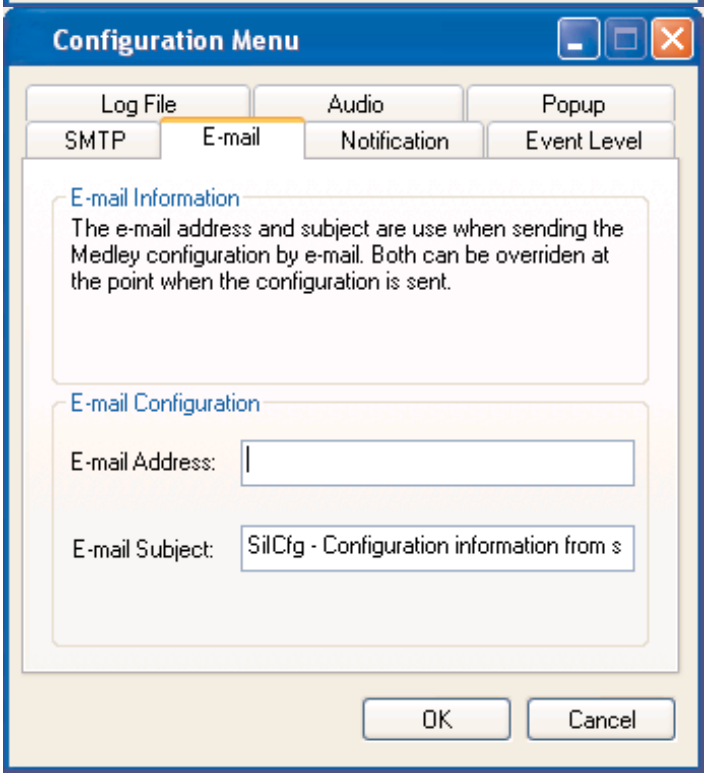
By clicking on the toolbox icon in the top left of the SATARaid GUI window, or right-clicking on the conductor icon in the bottom right of the computer screen (with other start-up icons), the user may configure SATARaid including customizing the settings for SMTP, E-mail, Notification, Event Level, Log File, Audio, and Popup.

SMTP

The SMTP server is the server that is used to send e-mails. Normally, the network administrator knows what this name is. Both the name and domain must be entered.

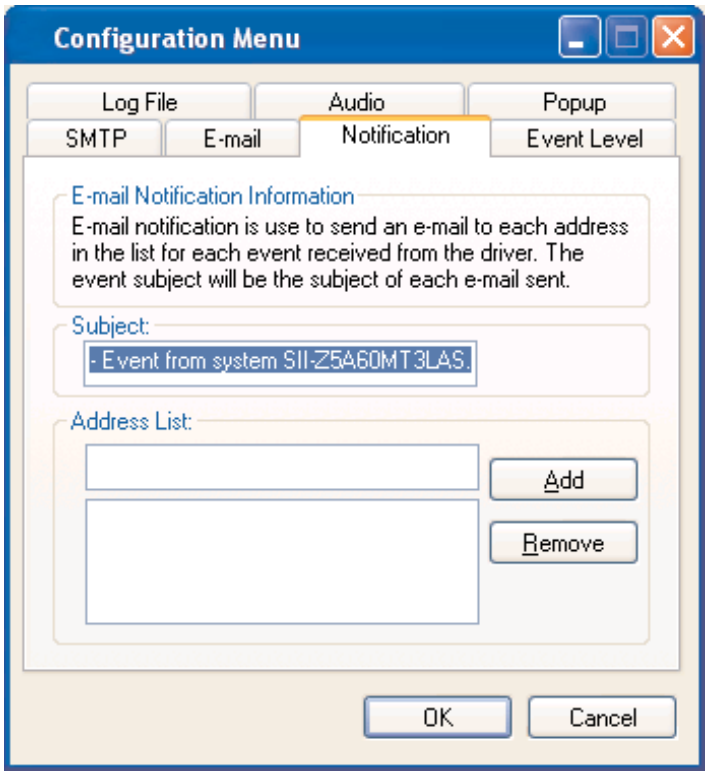
E-Mail

The current SATARaid configuration may be sent via e-mail. Using the e-mail tab in the SATARaid Configuration Menu, the user may set the default e-mail address and subject line to where the configuration would be sent. This, however, can be overridden at the time of sending the email.



Notification

When different types of events occur, SATARaid may be configured to send notices to assigned individual e-mail addresses. Using the Notification tab, all e-mail addresses desired to receive the notices may be entered.



Event Level

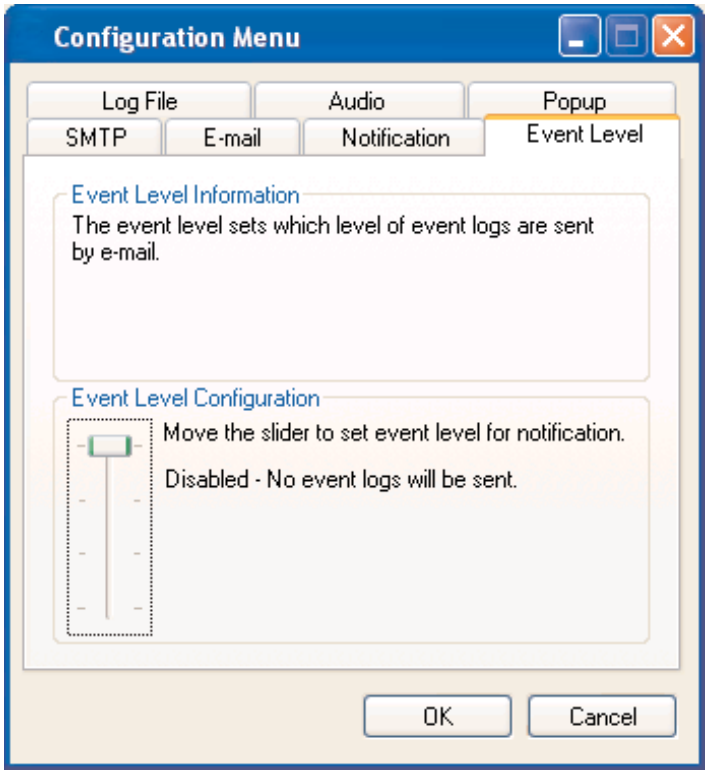
There are different types of e-mail notifications that may be sent which are set with the Event Level tab. The different levels are:

Disabled - No event logs will be sent.

Informational - The following events will be sent:
- Informational
- Warnings
- Errors

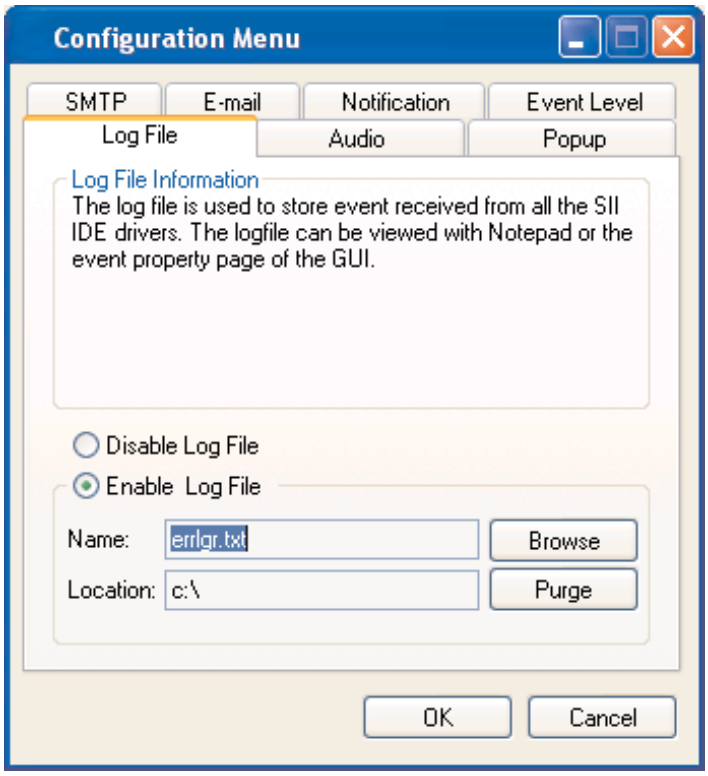
Warning - The following events will be sent:
- Warnings
- Errors

Errors - The following events will be sent:
- Errors



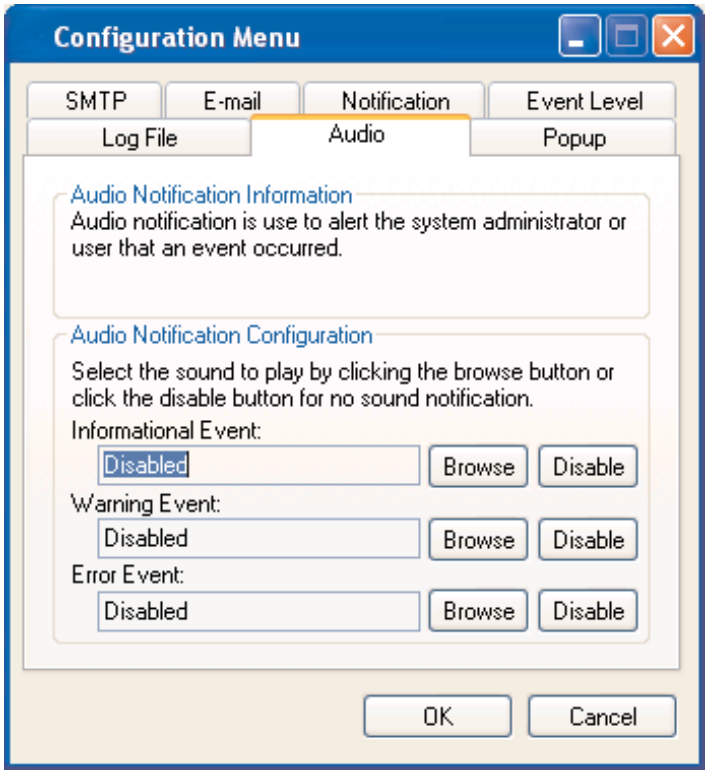
Log File

The log file is used to store event information received from all the Silicon Image RAID drivers. The log file is a text file and can be viewed with Notepad or SATARaid. Use the Log File tab to set where the log file should be stored and the name of the file as well.



Audio

The user may set different audio alerts for the different levels of events.



Popup

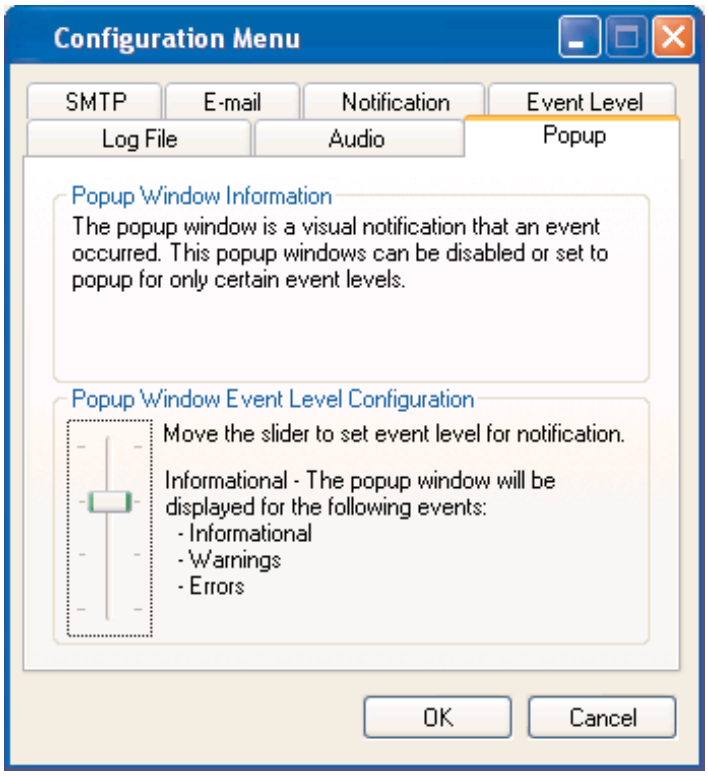
The popup window is a visual notification that an event occurred. The popup window can be disabled or set to popup for only certain event levels. The different levels are:

Disabled - No popup will occur.

Informational - The popup window will be displayed for the following events:
- Informational
- Warnings
- Errors

Warning - The popup window will be displayed for the following events:
- Warnings
- Errors

Errors - The popup window will be displayed for the following events:
- Errors


Configuration Menu
SMTP
E-mail
Notification
Event Level
Log File
Audio
Popup
Popup Window Information
The popup window is a visual notification that an event occurred. This popup windows can be disabled or set to popup for only certain event levels.
Popup Window Event Level Configuration
Move the slider to set event level for notification.
Informational - The popup window will be displayed for the following events:
- Informational
- Warnings
- Errors
OK
Cancel